

SPIDERS FROM RIVERSIDIAN COASTAL SAGE SCRUB WITH COMPARISONS TO DIEGAN SCRUB FAUNA (ARACHNIDA: ARANEAE)

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Abstract.—We provide a list of 166 spider species collected from Riversidian coastal sage scrub (CSS) located within the Southwestern Riverside County Multispecies Reserve in southern California. Spiders were collected over a two-year period from pitfall traps, vacuum samples, and malaise traps; additional species were collected by hand or in yellow pan traps. One hundred and twenty-seven species, representing 30 araneomorph families and one mygalomorph family, were separated from the combined pitfall, vacuum, and malaise samples from 24 undisturbed Riversidian CSS plots. Three species occurred only in malaise samples, 58 species occurred only in pitfall samples, and 37 species occurred only in vacuum samples. An additional 39 species were collected by hand or in yellow pan traps (two species), among which were representatives of two mygalomorph families not represented in pitfall catches. Over 33% of the Riversidian species were unrecorded from our recent Diegan CSS study bringing the combined total to 255 species. Eighteen species are new records for Riverside County. At least eleven species are believed to be undescribed. Six non-native species, *Holocnemus pluchei* (Scopoli), *Dysdera crocata* C. L. Koch, *Zelotes nilicola* O. P.-Cambridge, *Oecobius annulipes* Lucas, *Steatoda triangulosa* (Walckenaer), and *Menemerus bivittatus* (Dufour), were among the species collected. Phenology data are provided for the 12 most prevalent species. Natural history data are provided for habitat preference of several species and on ant predation by three species. Non-native and endemic spider taxa are discussed. Comparison of Riversidian fauna to Diegan fauna suggested higher species diversity in Diegan CSS.

Key Words.—Arachnida, Araneae, spiders, species list, coastal sage scrub, endemic species.

We present here a significant addition to the knowledge of the spider fauna of coastal sage scrub (CSS) from samples obtained from an ecologically threatened southern California coastal sage scrub association, Riversidian CSS (Westman 1983). Because CSS communities, in general, are distributed at lower elevations in California along the coast or adjacently inland, they are subject to extensive clearing as the demands of urbanization are met. This study provides an invaluable database for potential use by conservationists, developers, and planners, involved either directly in CSS ecosystem research or indirectly in the planning and development of reserves to protect this fragile ecotype in southern California. It also provides arachnologists and ecologists alike with data pertaining to species composition and richness, relative abundance, endemism, and the apparent impact of non-native species in CSS. To date, this study and our previous Diegan CSS study (Prentice et al. 1998) remain the only examinations of CSS spider fauna and, together, create one of the most comprehensive lists of Araneae assembled for any specific ecosystem type in the United States.

Our study sites were located within the Southwestern Riverside County Mul-

tispecies Reserve (SRCMR), a reserve owned by Metropolitan Water District (MWD) and jointly managed by federal, state, county, and MWD personnel. This area includes undisturbed coastal sage scrub surrounding Lake Skinner and extending 1 km south, 4 km east to the Tocalota Hills, and 9.5 km to the north, climbing in elevation up through Rawson Canyon and then descending to (what is now) Diamond Valley Lake. Chaparral communities, oak groves, and riparian areas are associated with CSS in several regions within the reserve. The 1993 Winchester Fire burned large portions of SRCMR, leaving a mosaic of unburned areas on the north side of the lake (Fig. 1, regions C (northern third), D, E). The areas to the west and south of Lake Skinner were missed by the fire (Fig. 1, regions A, B, C (southern two thirds)), but a large portion of the CSS and chaparral through Rawson Canyon to the northern boundary was destroyed (Fig. 1, regions G, F).

There are four major California CSS associations. Three have geographical limits along the Pacific coast; one occurs further inland (Westman 1983). These floristic associations are defined mainly by a geographic/climatic gradient of evapotranspirative stress, which increases from north to south and from coastal to inland (Axelrod 1978; Desimone & Burk 1992; Westman 1981, 1983). Soil nitrogen levels and air pollution are also believed to be critical factors that influence floristic associations (Westman 1981). Riversidian CSS extends from inland Los Angeles County through the southwestern corner of San Bernardino County, western Riverside County, and into inland San Diego County and has a somewhat different floristic composition than the more coastally distributed Diegan CSS (Westman 1983). Although the percentage of annual forb and grass cover generally increases in CSS from north to south, the Riversidian region has a significantly higher percentage of annual cover (primarily introduced species) and a lower percentage of shrub cover than the Diegan region (Westman 1983). The relatively sparse shrub cover and dense annual cover in Riversidian CSS are believed to be mainly the result of evapotranspirative stress (due to higher summertime temperatures) and increased ozone levels (Westman 1983). Vegetation surveys (unpublished data) conducted within both our Diegan and Riversidian sites showed that unburned sites at SRCMR had both relatively sparse shrub cover and lower shrub stature than sites at MCBCP/MNAS. California Buckwheat (*Eriogonum fasciculatum*), Yerba Santa (*Eriodictyon crassifolium*), Brittlebush (*Encelia farinosa*), Black Sage (*Salvia mellifera*), and Bush Mallow (*Malacothamnus fasciculatus*) were more common in unburned sites at SRCMR while California Sage (*Artemisia californica*), White Sage (*Salvia apiana*), and Laurel Sumac (*Malosma laurina*) were more common in sites at MCBCP/MNAS. Bush Monkeyflower (*Mimulus aurantiacus*) and both Broom Baccharis (*Baccharis sarothroides*) and Coyote Brush (*Baccharis pilularis*) were common at MCBCP/MNAS sites but absent from sites at SRCMR. In contrast, Bush Penstemon (*Kekiella* sp.) was common at SRCMR but absent from sites at MCBCP/MNAS.

Our objectives are to: (1) develop an inventory of the spider fauna collected in Riversidian CSS which includes the number of adults of each sex per species per collecting period, (2) compare spider assemblages of Riversidian and Diegan CSS, (3) develop phenology data for the most abundantly sampled Riversidian species with comparisons to the same taxa sampled in Diegan scrub (Prentice et al. 1998), (4) propose a subset of probable endemic species to Riversidian and/

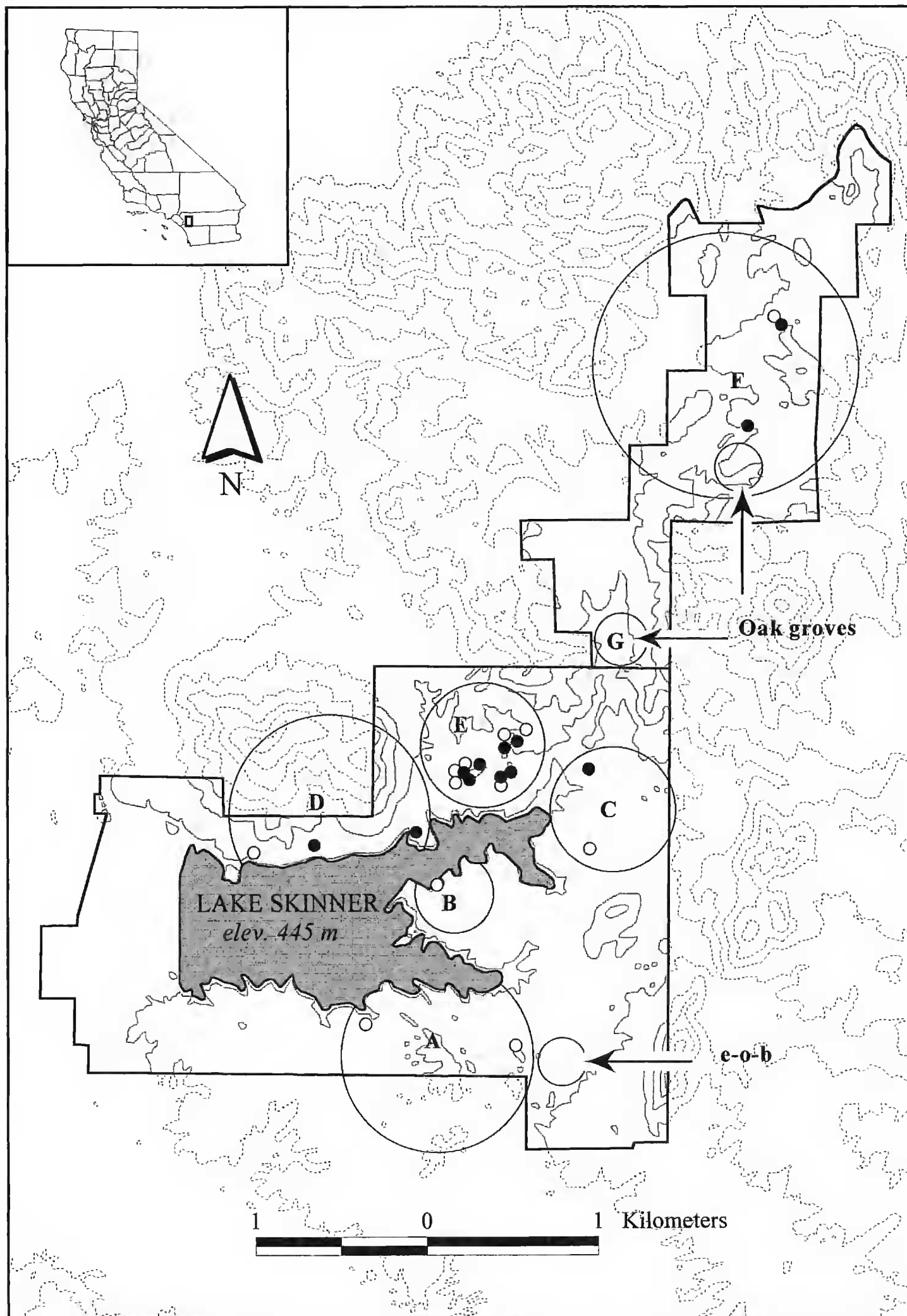


Figure 1. Map of SRCMR in SW Riverside County, CA showing geographic regions of collections. Regions 'A-F' encompass pitfall, vacuum, and malaise sampling sites. Regions 'G', 'e-o-b' (entrance station outbuilding area), and the smaller encircled area within region 'F' (oak grove), were localities of hand collection only. The open circles (○) within regions 'A-F' represent unburned sites and the solid circles (●) represent sites burned by the Winchester Fire of 1993. Regions 'A', 'B', and 'e-o-b' were not burned; the understory of the oak groves (regions F and G) was burned but the oaks survived.

or Diegan CSS (area endemics), (5) discuss the apparent status of non-native species in CSS, and (6) provide natural history data on habitat preference and ant predation by two subsets of species, respectively.

MATERIALS AND METHODS

Study Sites.—We selected 24 circular sites representative of undisturbed Riversidian CSS scrub, each 100 m in diameter. Half (12) of these sites were located in areas recovering from the Winchester Fire of 1993 and the other half (12) were within areas that remained unburned (Fig. 1, regions A–F). Plots in the burned areas had substantially reduced shrub canopy cover and greater annual grass and forb cover than those plots in unburned areas which generally had dense canopies and little forb and grass understory, except occasionally around the trunks of the shrubs and under the overhanging branches. Unburned sites were chosen in a manner that maximized site distribution over SRCMR without encroaching on chaparral, oak, or riparian communities and that encompassed, within the combined twelve sites, as much of the variation in CSS composition as possible. Burned sites were selected, when possible, as pairs, adjacent to their unburned counterparts, but were otherwise selected to maximize site distribution.

Selection of Geographical Regions.—The grouping of sites into regions (Fig. 1) was based on three criteria, provision of locality data, geographical relationship, and practicality. Foremost, was to provide locality data for future workers wishing to sample any of the taxa that we collected at SRCMR. Although we have more precise locality data for each specimen sampled, inclusion here would prove both cumbersome and unnecessary. Therefore, the only logical method of reporting these data, was to assign sites to regions based on both proximity of the sites and geographical distinction of the encompassed regions (Fig. 1). Sites in regions A and B are on the south side of the lake or an arm of the lake (region B site is within 50 m of the shoreline) in an area that was not burned by the Winchester Fire. Sites in region C are the only sites that are relatively close to riparian areas, although the northern site was burned in the 1993 fire. Sites in region D are closely adjacent to the lake's north shore and more exposed to the predominant SW winds than other sites near the lake. Region E encompasses sites that are in close proximity to one another (burned and unburned). Sites in region F are isolated from other sites both by distance and elevation (640 m vs. 460 m). Region G encircles an oak grove (closely adjacent to CSS) where various hand-collected species were taken; it is intermediate in elevation (550 m).

Sampling Periods.—Sampling was performed by pitfall trap, vacuum, and malaise trap methods in September and December of 1996, in March, June, September, and December of 1997, and in March and June of 1998. Collections spanned the first two weeks of each sampling month. Although sampling was also performed in March and June 1996, pitfall and malaise traps were not set in June 1996 and only five pitfall traps were set (rather than seven, thereafter) in March 1996. As a result, specimens collected during these periods are excluded from the data presented in this study, with the exception of representatives of thirteen species, seven of which were collected only during these samplings (see Results). These 17 specimens are listed because their inclusion contributes to the knowledge of Riversidian spider fauna (Table 1).

Malaise Trap Sampling.—A single malaise trap (Bioquip® design, model

Table 1 A list of 166 species of Araneae from Riversidian CSS at Southwestern Riverside County Multispecies Reserve (SRCMR) in California. Of these, 127 species were collected from pitfall traps, vacuum samples, and malaise traps in September and December of 1996, March, June, September, and December of 1997, and March and June of 1998 (all specimens of 7 of these species were collected only in March or June 1996 samples and are reflected in the various totals). Specimens of the opposite sex of 11 of the 127 species and all specimens of the additional 39 species listed were collected only by hand (hand, Yellow Pan Trap (YPT), or sweepnet); hand-collected specimens are not included in the totals. Geographic regions are shown in Figure 1.

Species	¹ Geographic Regions		² Coll. Method	³ Collection Periods				Specim. Total
	Burned	Unburned		Mar	Jun	Sep	Dec	
MYGALOMORPHAE								
Ctenizidae								
<i>Bothriocyrtum californicum</i> (O. P.-Cambridge), 1874: 260	(E)		(h)					(1 ♀)
Cyrtacheniidae								
<i>Aptostichus atomarius</i> Simon, 1891:317	D	A,(A,E)	P (h)				4 ♂	4, (2 ♀)
<i>Aptostichus</i> sp. #1 (#118) ⁴		E	P				1 ♂	1
Theraphosidae								
<i>Aphonopelma steindachneri</i> (Ausserer), 1875: 199 (TRP coll.)		(E,F)	(h)					(6 ♂ 1 ♀)
<i>Aphonopelma</i> sp. #1 ('eutylenum' type'): Prentice, 1997 (TRP coll.)	(D,E)	(A,E)	(h)					(9 ♂ 4 ♀)
ARANEOMORPHAE								
Agelenidae								
<i>Agelenopsis aperta</i> Gertsch, 1934: 25		E	P			1 ♀		1
<i>Calilena stylophora</i> Chamberlin & Ivie, 1941: 610	C,E,F	E,F	P	3 ♀	6 ♂ 1 ♀	4 ♂ 1 ♀	13 ♀	28
<i>Rualena balboae</i> (Schenkel), 1950: 82		F	P				1 ♀	1
Amaurobiidae								
species #1: undescribed species, new genus (CAS; TRP coll.)	C,E	B,E	P	2 ♀			1 ♂ 1 ♀	4
Anyphaenidae								
<i>Anyphaena californica</i> (Banks), 1904: 339		[E]	[M]	[1 ♂]				1
Araneidae								
<i>Argiope argentata</i> (Fabricius), 1775: 443		(E)	(h)					(1 ♀)
<i>Argiope trifasciata</i> (Forsk.) 1775: 86	E	A	V			2 ♂		2
<i>Cyclosa turbinata</i> (Walckenaer), 1841: 140	C		V	1 ♀				1
<i>Eustala californiensis</i> (Keyserling), 1885: 525	E	D,E	VM	1 ♂ 1 ♀	1 ♂			3
<i>Eustala conchlea</i> (McCook), 1888: 199	(D)		(h)					(1 ♀)
<i>Eustala rosae</i> Chamberlin & Ivie, 1935: 22	(D)		(h)					(1 ♀)
<i>Hypsosinga funebris</i> (Keyserling), 1893: 37	[E]		[V]	[1 ♂ 1 ♀]				2
<i>Larinia directa</i> (Hentz), 1847: 478		D	V		1 ♀			1
<i>Mastophora cornigera</i> (Hentz), 1850: 20	[E]		[V]		[1 ♂]			1
<i>Metepeira crassipes</i> Chamberlin & Ivie, 1942: 66	D	C,E	V		4 ♂ 2 ♀			6

Table 1. Continued.

<i>Metepeira foxi</i> Gertsch & Ivie, 1936: 66	(D)	(h)			(1♂)
<i>Metepeira grandiosa grandiosa</i> Chamberlin & Ivie, 1941: 17	D,E,F	F	V	6♂ 2♀	8
<i>Neoscona crucifera</i> (Lucas), 1839: 42	(C)		(h)		(1♀)
<i>Neoscona oaxacensis</i> (Keyserling), 1863: 97	D		V P		2
Caponiidae					
<i>Orthonops zebra</i> Platnick, 1995: 15	C	E	P	2♂	2
Corinnidae					
<i>Castianeira athena</i> Reiskind, 1969: 228		(F, oak grove)	(h)		(1♀)
<i>Castianeira occidens</i> Reiskind, 1969: 211		A	P	1♂	1
Dictynidae					
^{RC} <i>Blabomma sanctum</i> Chamberlin & Ivie, 1937: 221		B,E	P	2♀	13♂ 5♀
<i>Blabomma</i> sp. #4 (#436)		A,C,E	P	1♀	2♀
<i>Blabomma</i> sp. #5 (#446)	D,E	B,D,E,F	P	2♂	14♂
<i>Blabomma</i> sp. #6 (#445)		C,E	P	1♀	1♀
<i>Cicurina utahana</i> Chamberlin, 1919: 257	G	A	P		3♂
<i>Dictyna abundans</i> Chamberlin & Ivie, 1941: 6	C,D,E	A,E	V	1♂ 4♀	3♂ 3♀
<i>Dictyna agressa</i> Ivie, 1947: 2	(e-o-b)		(h)		(2♀)
<i>Dictyna calcarata</i> Banks, 1904: 342	(e-o-b)		(h)		(1♂)
<i>Dictyna cholla</i> Gertsch & Davis, 1942: 12		(B),E	P (h)	1♀	1, (1♂)
^{RC} <i>Dictyna sierra</i> Chamberlin, 1948: 8		B,E	V	1♂ 1♀	2
^{RC} <i>Emblyna consulta</i> (Gertsch & Ivie), 1936: 6		(E)	(h)		(1♂)
<i>Emblyna hoyi</i> (Chamberlin & Ivie), 1941: 7		B	P	1♂	1
<i>Emblyna linda</i> (Chamberlin & Gertsch), 1958: 148	D,E,F	B,D,F	P *V	2♂ 1♀	2♂ 11♀
<i>Emblyna reticulata</i> (Gertsch & Ivie), 1936: 7	D,E	B,E	V		3♂ 2♀
^{RC} <i>Mallos pearcei</i> Chamberlin & Gertsch, 1958: 45	(F, oak grove)		(h)		(1♀)
<i>Tivyna moaba</i> (Ivie), 1947: 2	F	(B)	P (h)	1♂	1, (3♀)
<i>Tricholathys jacinto</i> Chamberlin & Gertsch, 1958: 20	(G)		(h)		(1♀)
<i>Tricholathys monterea</i> Chamberlin & Gertsch, 1958: 22	D,E	A,E	P	33♂ 4♀	3♂ 4♀
<i>Yorima angelica</i> Roth, 1956: 4		E	P	4♂ 1♀	5
Diguetidae					
<i>Diguetia canites</i> (McCook), 1890, in 1889-1894: 135		E	V	1♀	1
Dysderidae					
^{NN} <i>Dysdera crocata</i> C. L. Koch, 1839: 81		A	P	1♀	1
Filistatidae					
<i>Filistatinella</i> sp. #3 (#522)		A,C,E	P	3♂	3
Gnaphosidae					
<i>Callilepis gosoga</i> Chamberlin & Gertsch, 1941: 10	C-F	A,B,C,E,F	P	107♂ 25♀	4♂ 11♀

Table 1. Continued.

<i>Cesonia classica</i> Chamberlin, 1924: 619		A,E,F	P	5♂ 1♀	1f		7
<i>Drassyllus fractus</i> Chamberlin, 1936: 14	E	B,E	P	8♂ 3♀			11
<i>Drassyllus insularis</i> (Banks), 1900: 97	C-F	A-F	P	14♂ 1♀	26♂ 30♀	8♂ 24♀	103
^{RC} <i>Drassyllus lamprus</i> (Chamberlin), 1920: 193	E		P		1♂		1
<i>Gnaphosa californica</i> Banks, 1904a: 335	D,E	D,F	P		4♂	1♂ 2♀	7
<i>Haplodrassus maculatus</i> (Banks), 1904: 336	D,E,F	A-F	P	41♂ 26♀	1♀	4♂	72
<i>Herpyllus hesperolus</i> Chamberlin, 1928, in Cham. & Gert. 1928: 176	E		M	1♂			1
<i>Herpyllus propinquus</i> (Keyserling), 1887: 430		C	P		1♂		1
<i>Micaria deserticola</i> Gertsch, 1933: 2	E,[F]		P [M]	[1♂] 1♀			2
<i>Micaria gosiuta</i> Gertsch, 1942: 1	E		P			1♀	1
<i>Micaria icenoglei</i> Platnick & Shadab, 1988: 57	F		P		1♂		1
<i>Micaria jeanae</i> Gertsch, 1942: 4	D,E	A,B,E	P V M	1♂	1♂ 3♀	1♀	6
^{RC} <i>Nodocion utus</i> (Chamberlin), 1936a: 7		F	P		1♀		1
<i>Scopoides catharius</i> Chamberlin, 1922: 156	(E)	E	P (h)			1♀	1, (1♂)
<i>Zelotes gynethus</i> Chamberlin, 1919: 7	D,E,F	A,B,E,F	P	2♂ 15♀	2♀	1♂	7♂ 2♀
<i>Zelotes monachus</i> Chamberlin, 1924: 621	E	A,D,E,F	P		6♂ 5♀		11
^{NN} <i>Zelotes nilicola</i> (O. P.-Cambridge), 1874: 380		A,E	P		1♂ 1♀		2
<i>Zelotes skinnerensis</i> Platnick & Prentice, 1999: 672		E	P		2♂ 1♀		3
Hahnidae							
<i>Neoantistea santana</i> Chamberlin & Ivie, 1942: 29		E	P	1♀		1♀	2
Heteropodidae							
<i>Olios schistus</i> Chamberlin, 1919: 10	(E)		(h)				(1♂)
Homalonychidae							
<i>Homalonychus theologus</i> Chamberlin, 1924: 631	D	D,F	P		3♂		3
Linyphiidae							
<i>Ceraticelus</i> sp. #1 (#7)	[C]	E	V		[1♂]	2♀	3
<i>Erigone autumnalis</i> Emerton, 1882: 58		E	P	1♀			1
<i>Erigone dentosa</i> O. P.-Cambridge, 1894, in 1890-1902: 128	D,E,F	B,D,E,F	V *P		28♂ 19♀	2♂	49
<i>Frontinella pyramitela</i> (Walckenaer), 1841: 261	E		V		1♂		1
^{RC} <i>Linyphantes aliso</i> Chamberlin & Ivie, 1942: 53	E		V		1♀		1
^{RC} <i>Linyphantes microps</i> Chamberlin & Ivie, 1942: 53	E,F	C	P	2♂ 2♀			4
<i>Linyphantes</i> sp. # 5	(E)		(h)				(1♀)
<i>Meioneta</i> sp. #2 (#53)	D,E,F	B,D,E,F	P	5♂ 5♀	2♂ 4♀	7♂ 1♀	24
<i>Meioneta</i> sp. #3 (#460P)	E	A,E	V P	3♂ 2♀	1♀	1♀	7
<i>Microlinyphia mandibulata punctata</i> Chamberlin & Ivie, 1943: 24	E	E	V P	1♂	1♂ 2♀		4
<i>Spirembolus erratus</i> Millidge, 1980: 151		(B)	(h)				(1♂)
<i>Spirembolus phylax</i> Chamberlin & Ivie, 1935: 19	C,E	A	V P	1♀	1♀	1♂	3

Table 1. Continued.

<i>Spirembolus pusillus</i> Millidge, 1980: 128	D,E,F	A,E	P	1♀			7♂	8	
<i>Spirembolus tortuosus</i> (Crosby), in Chamberlin, 1925: 116	C-F	A,C-F	P*V	5♀			85♂	90	
<i>Spirembolus redondo</i> (Chamberlin & Ivie), 1945: 225	(F)		(h)					(1♀)	
<i>Tennesseellum formicum</i> (Emerton), 1882: 71	C,E,(F)		P(h)	3♀	1♀			4, (1♂)	
^{RC} <i>Wubana drassoides</i> (Emerton), 1882: 72		(B)	(h)					(1♂ 2♀)	
Liocranidae									
<i>Drassinella gertschi</i> Platnick & Ubick, 1989: 5	(E)		(h)					(1♂ 1♀)	
<i>Phrurotimpus mateonus</i> (Chamberlin & Gertsch), 1930: 141	F	A-E	P	1♂ 4♀	1♂ 2♀			8	
^{RC} <i>Scotinella kastoni</i> (Schenkel), 1950: 73	E	E	P	2♀	1♀		1♀	4	
Lycosidae									
<i>Alopecosa kochi</i> (Keyserling), 1876: 636	C-F	B,E,F	P	18♂ 6♀			10♂ 1♀	35	
<i>Pardosa californica</i> Keyserling, 1887: 483	(F)		(h)					(1♂)	
<i>Pardosa ramulosa</i> (McCook), 1894, in 1889-1894, pl. 30	[E]	E	P	[1♂] 1♀				2	
<i>Schizocosa maxima</i> Dondale & Redner, 1978: 165		(A)	(h)					(1♂)	
<i>Schizocosa mccooki</i> (Montgomery), 1904: 283	D,E,F	A,B,D,E,F	P		25♂ 2♀	1♀	1♀	29	
Mimetidae									
<i>Mimetus hesperus</i> Chamberlin, 1923: 5	C,E,F		VMP	4♀				4	
Miturgidae									
<i>Cheiracanthium inclusum</i> (Hentz), 1847: 451	C-F	A,E	MV	2♂ 1♀	4♂ 1♀	1♂ 3♀	1♀	13	
<i>Syspira synthetica</i> Chamberlin, 1924: 665	E	C	P		2♀			2	
Oecobiidae									
^{NN} <i>Oecobius annulipes</i> Lucas, 1849: 102		D,E	V				1♂ 1♀	2	
Oonopidae									
<i>Oonops</i> sp. #1 (TRP coll.)		(B)	(h)					(9♂ 9♀)	
<i>Scaphiella hespera</i> Chamberlin, 1924: 594	C,D,E	E	P	1♂	2♂	2♂ 2♀		7	
Oxyopidae									
<i>Oxyopes salticus</i> Hentz, 1845: 196	E,[E]		V		[1♂] 1♀			2	
<i>Oxyopes scalaris</i> Hentz, 1845: 196	E	A	V		1♂ 1♀			2	
<i>Oxyopes tridens</i> Brady, 1964: 472	E	A,C,D,E	PV		2♂ 2♀	1♀		5	
<i>Peucetia longipalpis</i> F. P.-Cambridge, 1902, in 1897-1905: 340	E	F	V		1♂ 1♀			2	
<i>Peucetia viridens</i> (Hentz), 1832: 105	D,E		V		1♂ 1♀	1♀		3	
Philodromidae									
<i>Apollophanes texanus</i> Banks, 1904: 113		E	V		1♀			1	
^{RC} <i>Ebo albocaudatus</i> Schick, 1965: 77		D	P		1♂			1	
^{RC} <i>Ebo andreaanae</i> Schick, 1965: 82		(B)	(h)					(1♂)	
<i>Ebo californicus</i> (Gertsch), 1933: 14	C,D	E	VMP	3♂			2♀	5	
^{RC} <i>Ebo evansae</i> Sauer & Platnick, 1972: 41	(E)		(h)					(1♀)	

Table 1. Continued.

<i>Ebo mexicanus</i> Banks, 1898: 256		A	V	1♂			1♂	2
<i>Philodromus californicus</i> Keyserling, 1884: 676		(e-o-b)	(h)					(1♂ 1♀)
<i>Philodromus chamisis</i> Schick, 1965: 50	D,E		VM	1♂	1♂			2
^{RC} <i>Thanatus formicinus</i> (Clerck), 1757: 134		(D)	(h)					(1♀)
<i>Tibellus chamberlini</i> Gertsch, 1933: 10	E	E,F	V		1♂ 2♀			3
Pholcidae								
<i>Holocnemus pluchei</i> (Scopoli), 1763: 404		(e-o-b)	(h)					(1♀)
<i>Physocyclus californicus</i> Chamberlin & Gertsch, 1929: 102		(e-o-b)	(h)					(2♂ 3♀)
<i>Psilochorus</i> sp. #1 (#103)	C-F	A-E	P	8♂ 7♀	14♂ 6♀	24♂ 14♀	4♀	77
Plectreuridae								
<i>Plectreurys conifera</i> Gertsch, 1958: 14	D,F	B	P	1♂	1♂ 1♀			3
Salticidae								
<i>Habronattus californicus</i> (Banks), 1904: 117	C,E,F	A-E	P *M	1♂ 2♀	2♂ 11♀	3♂ 21♀		40
<i>Habronattus hirsutus</i> (Peckham & Peckham), 1888: 64		B,D,E,F	V	1♂	2♂ 1♀	2♂ 2♀	1♂	9
<i>Habronattus pyrrithrix</i> (Chamberlin), 1924: 693	(E)		(h)					(1♀)
<i>Habronattus schlingeri</i> (Griswold), 1979: 135		(B)	(h)					(1♂)
<i>Habronattus tranquillus</i> Peckham & Peckham, 1901: 201	D,E,F	F	V P		2♂ 6♀			8
<i>Menemerus bivittatus</i> (Dufour), 1831: 369		(e-o-b)	(h)					(1♂ 1♀)
<i>Metaphidippus chera</i> (Chamberlin), 1924: 683	C,E		VM	1♂	1♂	1♀		3
<i>Metaphidippus manni</i> (Peckham & Peckham), 1901: 326	E		V	1♀				1
<i>Metaphidippus vitis</i> (Cockerell), 1894: 207	C,D,E	C-F	VM	3♂ 3♀	2♂ 4♀	2♂	1♂ 2♀	17
<i>Pelegrina aeneola</i> (Curtis), 1892: 332		F	M	1♀				1
<i>Pellenes limatus</i> Peckham & Peckham, 1901: 217	(F)		(h)					(1♂ 1♀)
<i>Phidippus ardens</i> Peckham & Peckham, 1901: 288		B,(A,E)	P (h)			1♀		1, (2♂)
<i>Phidippus californicus</i> Peckham & Peckham, 1901: 289		[A]	[V]		[1♂]			1
<i>Phidippus johnsoni</i> Peckham & Peckham, 1883: 22	C,F,(D,E)	(A)	MP (h)	3♂				3, (5♀)
<i>Phidippus mkites</i> Chamberlin & Ivie, 1935: 41	(E)	F	P (h)	1♀				1, (2♂)
<i>Phidippus octopunctatus</i> (Peckham & Peckham), 1883: 6	D	(E)	P (h)			1♀		1, (2♂)
<i>Salticus palpalis</i> (Banks), 1904: 360	C-F	D,E	V P M	1♂ 4♀	3♀			8
<i>Sarinda cutleri</i> (Richman), 1965: 133		B	V		1♀			1
<i>Sitticus dorsatus</i> (Banks), 1895: 97	E	E	P V	1♂ 1♀	1♂ 2♀			5
<i>Synageles occidentalis</i> Cutler, 1987: 343	E,F		VM	2♂	2♀			4
Tengellidae								
^{RC} <i>Anachemmis dolichopus</i> Chamberlin, 1919: 139	[E],F	A,F	P	2♂ [1♀]			1♂	4
Tetragnathidae								
<i>Tetragnatha guatemalensis</i> O. P.-Cambridge, 1889, in 1889-1902: 8	D	D	VM		4♂ 1♀			5
^{RC} <i>Tetragnatha pallescens</i> F. P.-Cambridge, 1903, in 1897-1905: 436	[D,E]		[V]	[2♀]				2

Table 1. Continued.

<i>Tetragnatha versicolor</i> Walckenaer, 1841: 215		D	VM	2♂ 1♀		3
Theridiidae						
<i>Achaearana tepidariorum</i> (C. L. Koch), 1841: 75		(nr. e-o-b)	(h)			(1♀)
<i>Dipoena abdita</i> Gertsch & Mulaik, 1936: 6		C	P		1♀	1
^{RC} <i>Enoplognatha selma</i> Chamberlin & Ivie, 1946: 3	(E)	E,(B)	P (h)	1♂		1, (4♀)
<i>Euryopsis californica</i> Banks, 1904: 345	D		V		1♀	1
<i>Latrodectus hesperus</i> Chamberlin & Ivie, 1935: 15		(E)	(h)			(1♀)
^{NN} <i>Steatoda triangulosa</i> (Walckenaer), 1802: 207		(culvert nr. e-o-b)	(h)			(1♂ 2♀)
<i>Steatoda washona</i> Gertsch, 1960: 21	(E)		(h)			(1♂)
<i>Theridion dilutum</i> Levi, 1957: 37	E	A	V	1♂	2♀	3
^{RC} <i>Theridion llano</i> Levi, 1957: 28	[E]	[A,D],(B)	[V P] (h)	[1♀]	[2♀]	3, (1♂)
<i>Theridion melanurum</i> Hahn, 1931: (pl. 3, fig. a.)		(culvert nr. e-o-b)	(h)			(1♀)
<i>Theridion rabuni</i> Chamberlin & Ivie, 1944: 53		B,[D],E	V		[1♂] 3♀	4
<i>Tidarren haemorrhoidale</i> (Bertkau), 1880: 78	(F)		(h)			(1♀)
Thomisidae						
<i>Misumenops aikoae</i> Schick, 1965: 131		vac shaff	V	1♀		1
<i>Misumenops californicus</i> (Banks), 1896: 91	[E]		[V]	[1♀]		1
<i>Misumenops deserti</i> Schick, 1965: 124	D,E		V		1♂ 2♀	3
<i>Misumenops importunus belkini</i> Schick, 1965: 131	E	B,C	V	3♂ 1♀	1♂	1♂ 6
<i>Misumenops lepidus</i> (Thorell), 1877: 498	C,E,F	A,C	V	8♂	1♂ 2♀	11
<i>Misumenops rothi</i> Schick, 1965: 117	E	D,E,F	V		4♂ 1♀	5
<i>Xysticus californicus</i> Keyserling, 1880: 37	C-F		P *V	27♂ 3♀	3♀	33
<i>Xysticus gertschi</i> Schick, 1965: 159		E	V	1♀		1
<i>Xysticus montanensis</i> Keyserling, 1887: 479	(F)	(B)	(h)			(2♀)
Total				354	511	147
					211	1223

¹ Geographic Regions A–G; letters in Burned and Unburned columns refer to condition of sites within the various regions; e-o-b = entrance station outbuilding (see Fig. 1).

² P = pitfall trap, V = vacuum sample, M = malaise trap, (h) = hand-collected. Collection methods are listed in order of greatest to least number of specimens collected by the particular method; second letter preceded by an asterisk (*) indicates that very few specimens were collected by that particular method.

³ Number of specimens collected are recorded under each period.

⁴ Number following an undetermined species number is the OTU reference number assigned to the particular species in our collection (i.e., *Aptostichus* sp. #1 (#118)).

^{NN,RC} (superscript to the left of listed species): NN = non-native species; RC = new species record for Riverside County, California.

() Hand collected specimens; parentheses around particulars in all except Species and Collection Period columns (dates of collection are provided in Table 2).

[] Specimens collected only in March or June 1996 by pitfall, vacuum, or malaise; brackets around particulars in all columns except Species and Total columns.

#2875AG) was erected near the center of each site and left for three days during each sampling period. Arthropods collected in the kill heads (containing KCN or 80% EtOH) were then transferred to plastic bottles containing 80% EtOH. A total of 192 malaise samples (576 trap/days) were collected.

Vacuum Sampling.—Five one-minute vacuum samples were collected at each site during each sampling period (Buffington & Redak 1998). Vegetation was vacuumed along portions of five 25 m line transects established from a center pole by randomly chosen degree points from North. Each sample consisted of vacuuming a 10×1 m (10 m^2) band along the transect for one minute beginning at either the 5 or 15 m mark (randomly selected). Live arthropods were extracted from the collected chaff using one-gallon cardboard extraction drums. The drums (ice-cream containers) were painted black inside and each lid fitted with the funnel-shaped neck portion (glued in place, narrow end out) of one-liter plastic soda bottle. Each funnel was roughened on the inside (for traction) and painted black. A plastic vial cap was bored to tightly fit over the mouth of each funnel in a manner that would allow a 40-dram collecting vial to be attached to the lid. Contents of the vacuum bags were placed into the drums. Drums were turned sideways with the plastic vial portion under blacklights for a period of three hours. Arthropods that had collected in the vials were then anesthetized with carbon dioxide and stored in 80% ethanol. Vacuum chaff was examined for additional specimens for a period of one minute. A total of 960 vacuum samples were collected and extracted.

Pitfall Trap Sampling.—Seven pitfall traps were placed at each site in a stratified random manner and left in place for the entire course of the study. Each trap consisted of a 473 ml (16 oz) plastic cup (9 cm, inside diameter) equipped with a funnel that narrowed to 3.2 cm and a fluid filled collection cup (fluid composition: 2.0 tablespoons odorless detergent and 1.0 tablespoon salt per gallon water). Pitfall cups were placed so that the rims were flush with the substrate surface. A square masonite board, supported by three 20-penny galvanized nails at approximately 2 cm above each trap, was used to protect the trap from desiccation and/or flooding and provided a dark refuge for arthropods. Traps were opened for a period of three days at each site during each sampling period. Pitfall contents were strained and transferred to 80% ethanol within seven hours of collection. A total of 1344 pitfall samples (4032 trap/days) were collected.

Vegetation Sampling.—Four 48 m transects were established at each plot. A pole marked in decimeters was dropped at a random location (point) within every 2 m section along each transect ($n = 96$ points per plot). Canopy species, height, and structure (by number of contacts within each decimeter), as well as ground cover, were then recorded at each point. Along three of the four transects at each plot, ground and canopy cover, per decimeter, were recorded. We were able to estimate relative cover of major shrubs, shrub structure, ground cover and rockiness at each site with these data.

Statistical Analysis.—We used species accumulation curves to compare spider diversity in Diegan and Riversidian CSS. This method allowed us to correct for the disparity in total number of specimens collected from each location. Curves and error bars were constructed with EcoSim, Version 3 (Gotelli & Entsminger 1999), by resampling using Monte Carlo randomizations of species abundance data. All adults and any immatures, identifiable as distinct species, were included.

Specimens from malaise samples were not considered because malaise traps were not implemented in Diegan sampling. We intend to include a more involved statistical comparison of the Arthropoda collected at both locations in a community-level study (in preparation).

Manuscript Organization and Terms.—The organization of the manuscript follows, for the most part, that of our previous Diegan CSS study (Prentice et al. 1998) to facilitate comparison of Riversidian and Diegan spider fauna. The use of the terms 'Diegan' and 'Riversidian' is in reference to our Diegan CSS study (and to Diegan CSS) and our present Riversidian CSS study (and to Riversidian CSS), respectively.

Specimens Examined and Species List.—A total of 5676 specimens from pitfall, vacuum, and malaise samples, 108 hand collected specimens, 2 specimens from yellow pan traps, and one specimen collected by sweepnet were examined. Only adults were considered in the species list (Table 1). Specimens that were collected by hand are not added in the various totals in Table 1; collection data for these specimens are in Table 2. Taxonomy follows Platnick (1989, 1993, 1997). Undetermined species are designated as sp. #1, sp. #2, etc.; listings starting with sp. #2, #3, etc. indicate that the species are considered to be different congeneric species than those designated as sp. #1, #2, etc. in Prentice et al. (1998). Gender and number of specimens are provided for each species for each season collected; collection method(s) and geographical region of collection are also provided for each species (Table 1; Fig. 1). Table 1 is the central component of the manuscript and should be referred to throughout the course of the text. Voucher specimens of listed species (Table 1) are deposited in the University of California, Riverside, Entomological Research Museum.

Abbreviations.—CAS, California Academy of Sciences; MCBCP, Marine Corps Base Camp Pendleton (San Diego County); MNAS, Miramar Naval Air Station (now Marine Corps Air Station Miramar) (San Diego County); SRCMR, Southwestern Riverside County Multispecies Reserve.

Sampling Biases.—The trapping materials and methods used during this study (excepting malaise traps) were essentially the same as those used during our Diegan study. Therefore, the sampling biases discussed in Prentice et al. (1998) also pertain to the present study. We provide here a brief summary of these biases. The small size of our pitfall traps precluded the collection of specimens of large size. Burrowing species were not accounted for unless collected by hand or an occasional wandering male fell into the trap. Web spinners that used subterranean retreats, had strong webs, and/or were nocturnal were minimally, if at all, collected by the vacuum method. Specimens of many web spinners and arboreal hunters and ambushers, that habitually drop or jump to the ground under conditions of unusually strong vibration, were minimally collected by the vacuum method.

RESULTS AND DISCUSSION

Spider Fauna of Riversidian CSS.—In addition to the previously published floristic distinctions between Riversidian and Diegan CSS types (Kirkpatrick & Hutchinson 1977; Westman 1981, 1983; DeSimone 1995), we found accompanying distinctions between the respective spider faunas. It appears that factors influencing the floristic structures of Riversidian and Diegan CSS ecosystems, such as seasonal rainfall patterns (including effective summer and winter mois-

Table 2. List of species collected by hand (hand, YPT, or sweepnet). An asterisk * preceding a binomial indicates that only specimens of the opposite sex, of the respective species collected by pitfall, vacuum, or malaise methods, were hand-collected; all specimens of all other species were collected only by hand. Dates of collection and data pertaining to particular habitats are provided. Unless otherwise indicated, specimens were collected in CSS; other collections were in areas adjacent to CSS communities. Collection of specimens other than by one of authors is denoted in the Collection Date column.

Species	Collection Date	Habitat
MYGALOMORPHAE		
Cyrtacheiniidae		
<i>*Aptostichus atomarius</i>	13 Dec 1997, 2 ♀: Coll: J. Bond	banks of ravine cuts
Theraphosidae		
<i>Aphonopelma steindachneri</i>	17 Jul 1997, 2 ♂; 21 Jul 1997, 1 ♂; 4 Aug 1997, 3 ♂; 28 Sep 1997, 1 ♀	(♂) on dirt rds., (♀) in burrow
<i>Aphonopelma</i> sp. #1	mid-May 1996, 1 ♀; 3 Sep 1997, 2 ♂; 11 Sep 1997, 2 ♂; 28 Sep 1997, 3 ♂; 29 Oct 1997, 1 ♂, 1 ♀; 26 Nov 1997, 1 ♂; 7 May 1998, 1 ♀	(♂) on dirt rds., (♀) in burrows
Ctenizidae		
<i>Bothriocyrtum californicum</i>	early Jul 1997, 1 ♀	in burrow
ARANEOMORPHAE		
Araneidae		
<i>Argiope argentata</i>	9 Sep 1997, 1 ♀	in web betw. shrubs
<i>Eustala conchlea</i>	16 Mar 1997, 1 ♀	against stem of shrub
<i>Eustala rosae</i>	21 Mar 1997, 1 ♀	against mustard stem
<i>Metepira foxi</i>	10 Feb 1998, 1 ♂	on drag line betw. shrubs
<i>Neoscona crucifera</i>	mid-Oct 1997, 1 ♀	riparian
Corinnidae		
<i>Castianeira athena</i>	7 Jun 1999, 1 ♀: Coll: C. Dunning	in fallen acorn, oak grove
Dictynidae		
<i>Dictyna agressa</i>	25 Mar 1997, 2 ♀	in webs, entr. stn. outbldg.
<i>Dictyna calcarata</i>	21 Mar 1998, 1 ♂	in web, entr. stn. outbldg.
<i>*Dictyna cholla</i>	20 Dec 1998, 1 ♂	grass/leaf litter
<i>Emblyna consulta</i>	4 Jun 1998, 1 ♂	in web, Calif. Buckwheat, branch tip
<i>Mallos pearcei</i>	21 May 1999, 1 ♀: Coll: C. Dunning	on oak leaf, oak grove
<i>*Tivyna moaba</i>	6 Dec 1998, 3 ♀	grass/leaf litter
<i>Tricholathys jacinto</i>	26 May 1999, 1 ♀: Coll: C. Dunning	in grass litter, oak grove
Gnaphosidae		
<i>*Scopoides catharius</i>	10 Mar 1998, 1 ♂ (pen.; def. molt 16 Mar 1998)	under rock
Heteropodidae		
<i>Olios schistus</i>	17 May 1998, 1 ♂	under dead stump
Linyphiidae		
<i>Linyphantes</i> sp #1	22 Nov 1997, 1 ♀	on wild oat stem
<i>Spirembolus erratus</i>	1 Dec 1998, 1 ♂; 29 Dec 1998, 1 ♂; 31 Dec 1998, 1 ♀	grass litter
<i>Spirembolus redondo</i>	3-5 Mar 1998, 1 ♀: Coll: M. Buffington	riparian, YPT
<i>*Tennesseellum formicum</i>	11-13 Mar 1998, 1 ♂: Coll: M Buffington	in shallow drainage, YPT
Liocranidae		
<i>Drassinella gertschi</i>	31 Dec 1998, 1 ♂, 1 ♀	under dead root, chaparral

Table 2. Continued.

Lycosidae		
<i>Pardosa californica</i>	9 Mar 1998, 1 ♂: Coll: M. Buffington	in shallow drainage, YPT
<i>Schizocosa maxima</i>	16 Mar 1997, 1 ♂ (pen.; def. molt, late May-early June 1997)	under board
Oonopidae		
<i>Oonops</i> sp. #1	1 Dec 1998, 1 ♂, 2 ♀; 20 Dec 1998, 8 ♂, 7 ♀	in fine, fluffed dead grass
Philodromidae		
<i>Ebo andreaanne</i>	19 Jun 1997, 1 ♂ (pen.; def. molt, 6-7 Dec 1997)	on shrub
<i>Ebo evansae</i>	17 Jul 1997, 1 ♀	on shrub
<i>Philodromus californicus</i>	27 Jan 1997, 1 ♂; 26 Feb 1998, 1 ♀	entr. stn outbldg
<i>Thanatus formicinus</i>	21 Mar 1997, 1 ♀	on ground
Pholcidae		
<i>Holocnemus pluchei</i>	31 Aug 1998, 1 ♀	in web, entr. stn. outbldg.
<i>Physocyclus californicus</i>	16 Jan 1997, 1 ♀; 25 Jun 1997, 1 ♀; early Jul 1997, 1 ♂, 1 ♀; mid-Sep 1997, 1 ♂	in web, entr. stn. outbldg.
Salticidae		
<i>Habronattus pyrrithrix</i>	12 Mar 1998, 1 ♀	on dirt road
<i>Habronattus schlingeri</i>	6 Dec 1998, 1 ♂ (pen.; def. molt, 4 Apr 1999)	sparse grass litter
<i>Menemerus bivittatus</i>	11 Sep 1997, 1 ♂ (pen.), 1 ♀; (def. molt (♂), 21-25 Nov 1997)	on wall, entr. stn. outbldg.
<i>Pellenes limatus</i>	1 Dec 1997, 1 ♂ (pen.; def. molt, early June 1998); 12 Mar 1998, 1 ♀	on ground; field with low grass
* <i>Phidippus ardens</i>	16 Jun 1997, 1 ♂; 25 Jun 1997, 1 ♂	under masonite pitfall lid; on Calif. Buckwheat
* <i>Phidippus johnsoni</i>	7 Mar 1997, 1 ♀; 16 Mar 1997, 1 ♀ (pen.; w/♂; molt, 20-24 Mar 1997); 20 Mar 1997, 1 ♀; 30 Mar 1997, 1 ♀; 6 Mar 1998, 1 ♀	on ground.; under wood; in PVC pipe centerpole
* <i>Phidippus nikites</i>	30 Jul-3 Aug & mid-Jul 1998 (def. molts), 2 ♂ (both (♂) reared from (♀) collected 10 Sep 1997)	(♀) under masonite over pitfall trap
* <i>Phidippus octopunctatus</i>	4-7 Jun & 20-21 Jun 1998 (def. molts), 2 ♂ (both (♂) reared from (♀) collected 11 Sep 1997)	(♀) on Calif. Buckwheat
Theridiidae		
<i>Achaeearanea tepidariorum</i>	6 Feb 1997, 1 ♀	in web on low shrub
* <i>Enoplognatha selma</i>	9-31 Dec 1998, 4 ♀ (pen.; molts 30 Dec 1998-25 Jan 1999)	grass/leaf litter
<i>Latrodectus hesperus</i>	5 Mar 1997, 1 ♀	in cavity under rock
<i>Steatoda triangulosa</i>	27 Jan 1997, 1 ♀; 14 Mar 1997, 1 ♀; 7 Jun 1998, 1 ♂	in web, inside culvert; in webs, entr. stn. outbldg.
<i>Steatoda washona</i>	4 Jun 1998, 1 ♂	on ground
* <i>Theridion llano</i>	29 Dec 1998, 1 ♂ (pen.; def. molt, 10-11 Jan 1998)	in web on shrub
<i>Theridion melanurum</i>	6 Feb 1997, 1 ♀	in web, entr. stn. outbldg.
<i>Tidarren haemorrhoidale</i>	13 Mar 1997, 1 ♀	in web, cavity of oak tree, oak grove
Thomisidae		
<i>Xysticus montanensis</i>	10 Mar 1997, 1 ♀; 1 Dec 1998, 1 ♀	grass litter

ture), variability in weather conditions and temperature, elevation gradients, general topography, and soil types, also affect the associated spider faunas. Not only did sampling comparisons between the Diegan and Riversidian CSS spider fauna reveal differences in species composition and relative abundance, but suggested a much higher species diversity in CSS (in general) than originally indicated in our Diegan study.

A total of 166 species (Table 1), representing 96 genera in 30 araneomorph and 3 mygalomorph families, were collected from Riversidian CSS communities at SRCMR compared with 200 species (112 genera in 31 araneomorph and 4 mygalomorph families) collected from Diegan CSS (Prentice et al. 1998). Of those collected at SRCMR, 127 species were collected by traditional trap or vacuum methods while 39 species were collected by hand. Three species occurred only in malaise samples, 58 species occurred only in pitfall samples, and 37 species occurred only in vacuum samples. In samples from the traditional methods (malaise, vacuum, and/or pitfall), Gnaphosidae were represented by the greatest number of species (19), followed by Salticidae (16), Dictynidae (14), Linyphiidae (13), Araneidae (9), Thomisidae (8), Theridiidae and Philodromidae (each with 6), Oxyopidae (5), Agelenidae, Liocranidae, Lycosidae, and Tetragnathidae (each with 3) (Table 3). The remaining families were represented by only one or two species. In our Diegan study, the eight most speciose families (excluding hand-collected species) in descending order were Gnaphosidae, Salticidae, Theridiidae, Linyphiidae, Dictynidae, Araneidae, Thomisidae, and Philodromidae (Table 3). Of the total number of species from SRCMR (including hand collected species), over 33% (55 species) were absent in Diegan samples, although 14 of these species were probably represented by juveniles (only) in Diegan samples (juveniles not included on species lists of either study).

Diversity within most taxa was generally greater in Diegan than in Riversidian CSS (Table 3). This pattern remained after we corrected for differences in specimen numbers across the respective CSS types (Fig. 2). For Riversidian CSS, the maximum species richness for specimens collected from pitfall traps and vacuum samples was 136. Given the species accumulation curves in Fig. 2, we estimated spider species richness in Diegan CSS to be 18% greater than in Riversidian CSS at the same specimen abundance (3302 specimens).

Mecicobothriidae (Mygalomorphae), Cybaeidae, and Nesticidae were represented only in Diegan samples but Caponiidae was represented only in Riversidian samples (Table 3). However, various species of Mecicobothriidae and Caponiidae have been collected from CSS/chaparral transition zones in both San Diego and Riverside Counties. One species of Nesticidae is known from both counties, and, at least, one species of Cybaeidae (most California species are distributed in central and northern counties) has been collected in San Diego County.

At the genus level, diversity was greater in Diegan CSS within ten shared families, most notably the Salticidae, but in Riversidian CSS diversity was greater within only four shared families, most notably the Pholcidae (Table 3). Although species composition was, in general, richer in Diegan than in Riversidian CSS, the reverse was true within six shared families, Cyrtaucheniidae, Araneidae, Dictynidae, Oxyopidae, Philodromidae, and Pholcidae (most notably, Dictynidae, Philodromidae, and Pholcidae), and seven shared genera (*Aptostichus*, *Metepeira*, *Oxyopes*, *Peucetia*, *Ebo*, *Steatoda*, and *Misumenops*). Diegan fauna was substan-

tially more speciose within the Theridiidae and Gnaphosidae and, to a lesser extent, within the Salticidae and Linyphiidae (Table 3).

March and June 1996 Sampling Additions.—Specimens (11) of species that were collected only in March and/or June 1996 samples are included on the species list and counted in the various totals. The species are as follows: *Hyposinga funebris* (Keyserling), *Mastophora cornigera* (Hentz), *Anyphaena californica* (Banks), *Phidippus californicus* Peckham & Peckham, *Theridion llano* Levi, *Tetragnatha pallescens* F. P.-Cambridge, and *Misumenops californicus* (Banks). The males of *Ceraticelus* sp. #1, *Micaria deserticola* Gertsch, *Pardosa ramulosa* (McCook), *Oxyopes salticus* Hentz, and *Theridion rabuni* Chamberlin & Ivie, and the female of *Liocranoides dolichopus* (Chamberlin) were also collected during these sampling periods and are included on the species list and counted in the various totals (6 specimens).

Hand-Collected Species.—Table 2 provides additional collection and habitat data, not provided in Table 1, for specimens of 50 species collected by hand. All specimens of 39 of these species were collected only by hand (hand, Yellow Pan Trap, or sweepnet). For each of the remaining 11 species, hand-collected specimens of only one sex (either male or female) are recorded in Table 2; specimens of the opposite sex of each of these species, respectively, were collected in pitfall, vacuum, and/or malaise samples.

New Riverside County Records.—Eighteen species are new records for Riverside County (indicated in Table 1 by the superscript 'RC'). County listings are provided here for three species reported only in counties north of and including Santa Barbara County: *Nodocion utus* (Chamberlin): Ventura County (Platnick & Shadab 1980); *Thanatus formicinus* (Clerck): Santa Barbara County, Monterey County, Yosemite National Park (Mariposa and/or Tuolumne Counties) (Dondale, Turnbull, & Redner 1964); *Dictyna sierra* Chamberlin: Sierra County (Chamberlin & Gertsch 1958). Boe (1986—unpublished; available at UC Riverside Science Library) reported *D. sierra* from Riverside County but we were unable to authenticate this record.

Females, determined to be *D. sierra*: (Chamberlin & Gertsch 1958), were previously known only from SE Oregon. The female epigynum as illustrated in Chamberlin & Gertsch (1958) is, decidedly, not the epigynum of the female that we collected at SRCMR. However, general coloration and morphological similarities between our male and female, as well as the close proximity of the sites from which they were collected, suggest that our specimens are conspecific.

Undescribed Species.—Approximately 6.5% and 9.5% of the listed Riversidian and Diegan species, respectively, are believed to be undescribed taxa. Taken together, the Riversidian and Diegan studies provided 26 undescribed species or approximately 10% of the combined totals of 255 species. These percentages, as well as the 18 new species records (above) for Riverside County and the 35 new records for San Diego County (Diegan study), are indicators of just how little we know of the arthropod community structure within the CSS system, in general.

The following 11–12 species (ten or eleven araneomorph and one mygalomorph species) collected at SRCMR, are believed to be undescribed taxa: *Blabomma* sp. #4, #5, #6 (Dictynidae); sp. #4 is probably the female of sp. #5 (undescribed status confirmed by D. Ubick (CAS)); species #1 (m, f), undescribed genus (Amaurobiidae) (family status suggested by D. Ubick, (CAS)); *Filistatinella* sp.

Table 3. Differences in the generic composition and the number of species within spider families represented in both Riversidian CSS samples (present study) and Diegan CSS samples (Prentice et al. 1998). Unlisted families were either represented in only one of the studies or were represented in both studies by the same species. Juveniles were considered in the elimination of unique genera. Representatives (Riversidian species) of a probable new genus/new species (n. g./n. s.) are tentatively placed in the Amaurobiidae. Riversid. = Riversidian.

Family	Riverside. # gen.	Diegan # gen.	Riversid. unique gen.	Diegan unique gen.	Riverside. sp./fam.	Diegan sp./fam.
Agelenidae	3	4		<i>?Hololena</i>	3	4
Amaurobiidae	1	2	n. g./n. s.	<i>Metaltella</i> <i>Zanomys</i> <i>Teudis</i>	1	2
Anyphaenidae	1	1	<i>?Anyphaena</i>		1	1
Araneidae	8	7	<i>Mastophora</i>		14	13
Corinnidae	1	3		<i>Corinna</i> <i>Meriola</i>	2	4
Cyrtacheniidae	1	1			2	1
Dictynidae	8	7	<i>Mallos</i>		19	16
Filistatidae	1	1			1	2
Gnaphosidae	10	12		<i>Urozelotes</i>	19	28
Hahniidae	1	2		<i>Calymmaria</i>	1	2
Linyphiidae	9	10	<i>Wubana</i>	<i>Idonella</i> <i>Ostearius</i> <i>Agrocea</i>	17	21
Liocranidae	3	4			3	4
Lycosidae	3	3			5	6
Mimetidae	1	1			1	2
Oonopidae	2	3	<i>Oonops</i>	<i>Opopaca</i> <i>Orchestina</i>	2	3
Oxyopidae	2	2			5	3
Philodromidae	5	4	<i>Thanatus</i>		10	7
Pholcidae	3	1	<i>Holocnemus</i> <i>Physocyclus</i>		3	1
Plectreuridae	1	2		<i>Kibramoa</i>	1	3
Salticidae	10	15		<i>Metacyrba</i> <i>Pckhamia</i> <i>Phanias</i> <i>Terralonus</i> <i>Thiodina</i>	20	26

Table 3. Continued.

Family	Riverside. # gen.	Diegan # gen.	Riversid. unique gen.	Diegan unique gen.	Riverside. sp./fam.	Diegan sp./fam.
Tengellidae	1	1			1	2
Theridiidae	8	10		<i>Argyroides</i> <i>Crustulina</i> <i>?Thymoites</i>	12	24
Thomisidae	2	3		<i>Coriarachne</i>	9	11

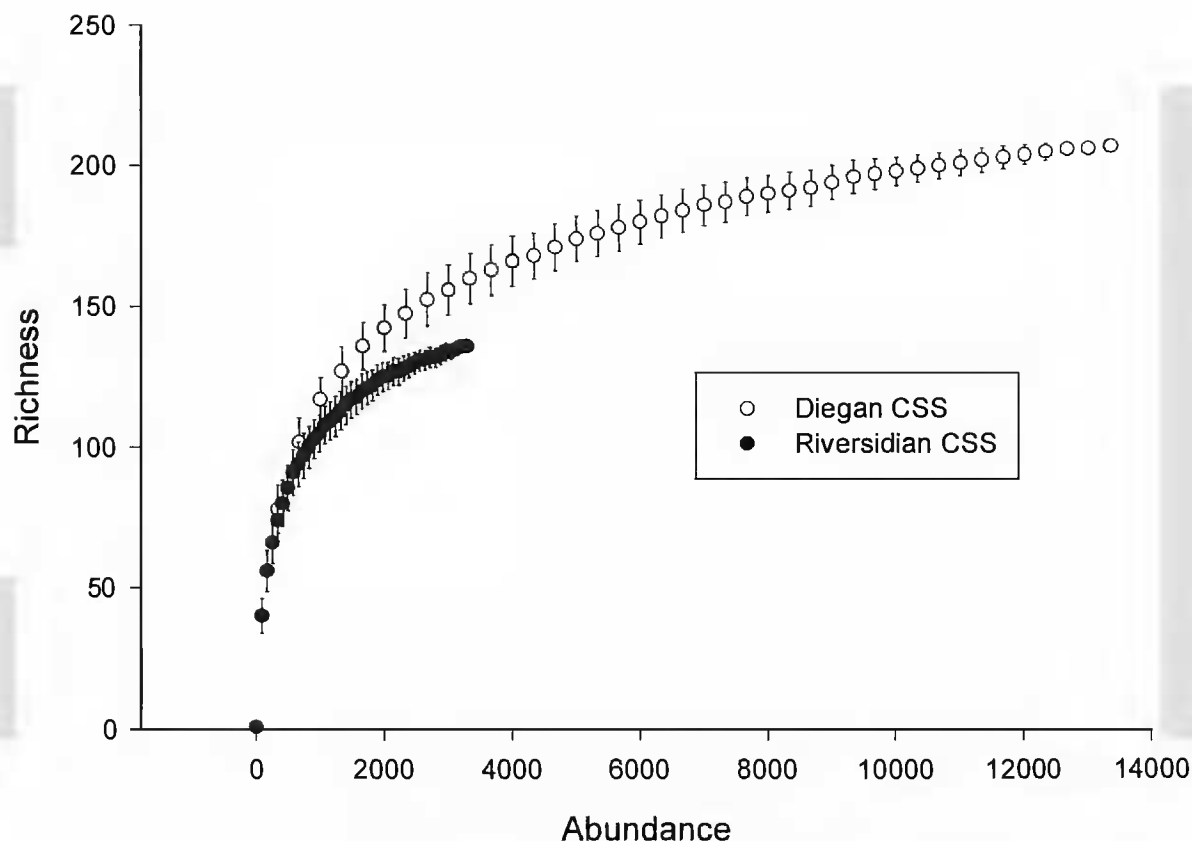


Figure 2. Species diversity of Araneae in Diegan and Riversidian CSS. Species accumulation curves were constructed by resampling species abundance data. Only adults and immature specimens, distinct enough not to be confused with other species, were included in calculations. Error bars represent 95% confidence intervals from Monte Carlo randomizations.

#3 (Filistatidae); *Ceraticelus* sp. #1, *Linyphantes* sp. #5, *Meioneta* sp. #2, #3 (Linyphiidae); *Oonops* sp. #1 (Oonopidae); *Psilochorus* sp. #1 (Pholcidae); *Aptostichus* sp. #1 (Cyrtaucheniidae) (status determined by J. Bond (Field Museum, Chicago)). Specimens of only four of these species, *Ceraticelus* sp. #1, *Meioneta* sp. #2, *Psilochorus* sp. #1, and *Aptostichus* sp. #1, were found in Diegan samples.

Phenology.—Twelve species, eleven from pitfall traps and one from vacuum samples, were collected in numbers large enough ($n > 25$) to provide an abstraction of their life cycles or, more precisely, their adult activity patterns. The phenologies of *Calilena stylophora* Chamberlin & Ivie ($n = 28$) and six other species ($n = 16-24$) are not discussed either because the species was not observed in the field, revision of genus in question is in need, comparative natural history literature was lacking, and/or specimens were hand collected.

In the majority of spider species with discreet breeding periods, first male maturation just precedes or roughly corresponds to the beginning of the respective breeding season, with maximum male activity peaking some time later. Peak female activity, on the other hand, roughly corresponds to copulatory periods and increased foraging or searching for oviposition sites prior to egg deposition (DeKeer & Maelfait 1997, Draney 1997). Phenograms (Fig. 3) do not reflect juvenile activity because many congeneric immatures could not be reliably separated.

Our two most prevalent species, *Callilepis gosoga* Chamberlin & Gertsch and *Drassyllus insularis* (Banks) (Figs. 3A and 3B, respectively), are apparently most active in Riversidian CSS between late spring to late summer and presumably mate during this period. In Diegan CSS, both species likely remain active somewhat longer (*C. gosoga* with slightly decreasing activity and *D. insularis* with

increasing activity between June and August) (Prentice et al. 1998). Although adult *D. insularis* did not occur in December samples, two of us (TRP & WRI) have hand-collected adults from November–February. Platnick & Shadab (1982) also reported that adults occur year-round. Adults of *C. gosoga* have been collected only between mid-April and early September (Platnick 1975). The female to male ratio of *C. gosoga* (~1:3) in samples (Fig. 3A) is decidedly lower than in *D. insularis* (~1.1:1) (Fig. 3B) which suggests foraging dissimilarities between females of the two species. We hypothesize that *C. gosoga* is an ant specialist (see: *Natural History* subsection: *Ant Predators* below). Mature females, in preparation for egg deposition, may restrict their hunting ranges to areas near harvester ant nests, in which case, they may only occasionally fall into randomly placed pitfall traps. Contrarily, males probably wander in search of females (rather than in search of prey), which increases their chances of falling into pitfall traps. Adults of *D. insularis* are probably active generalist predators with, perhaps, broad hunting ranges which may render females (and males) more subject to pitfall collection.

The remaining two common gnaphosids, *Haplodrassus maculatus* (Banks) and *Zelotes gynethus* Chamberlin, show increasing activity from late fall to early spring with peak activity in March (Figs. 3C, 3D, respectively). *Zelotes gynethus* seems to be more prevalent than *H. maculatus* in December, which may indicate an earlier and/or more prolonged mating period than that of the latter species. Moreover, *Z. gynethus* adults occurred year-round but those of *H. maculatus* were absent in September samples. Because only one *H. maculatus* female was collected in June samples, it seems likely the majority of adults expire during May. According to Platnick and Shadab (1975), adults had been previously taken from early January through mid-May. The lack of March samples from our Diegan study may have accounted for the apparent absence of *H. maculatus*; only a few juveniles were collected, which may have been either *H. maculatus* or *H. signifier*. Although California collection records indicate an inland distribution of *H. maculatus*, specimens have been collected within approximately 3 km of the coast in Baja, California (Platnick & Shadab 1975). In all probability, *H. maculatus* inhabits southern California Diegan CSS although it may not be as common as in Riversidian CSS.

In both our Diegan and Riversidian CSS studies, *Alopecosa kochi* (Keyserling) and *Schizocosa mccooki* (Montgomery) were the two most frequently collected wolf spiders; specimens of both species were collected together in many of the same plots during both studies. Although *A. kochi* are generally smaller than *S. mccooki*, there is substantial size overlap between the species which may result in competition for like-size prey items. The partitioning of resources may be accomplished both by differences in breeding seasons and daily activity patterns. *Alopecosa kochi* displays increasing activity from December to March (Fig. 3) and is diurnal (Hagstrum 1970) whereas *S. mccooki* shows peak activity in Riversidian CSS in June (Fig. 3G) and is nocturnal (Dondale & Redner 1978).

In Diegan CSS peak activity of *S. mccooki* occurred in August. The presence of penultimates (only) in late May and early June Diegan samples and the collection of two females in late August (26th and 29th) with partial broods still clinging to their abdomens suggest that breeding probably occurs between late June and late July in Diegan CSS. Had we sampled in July and early August

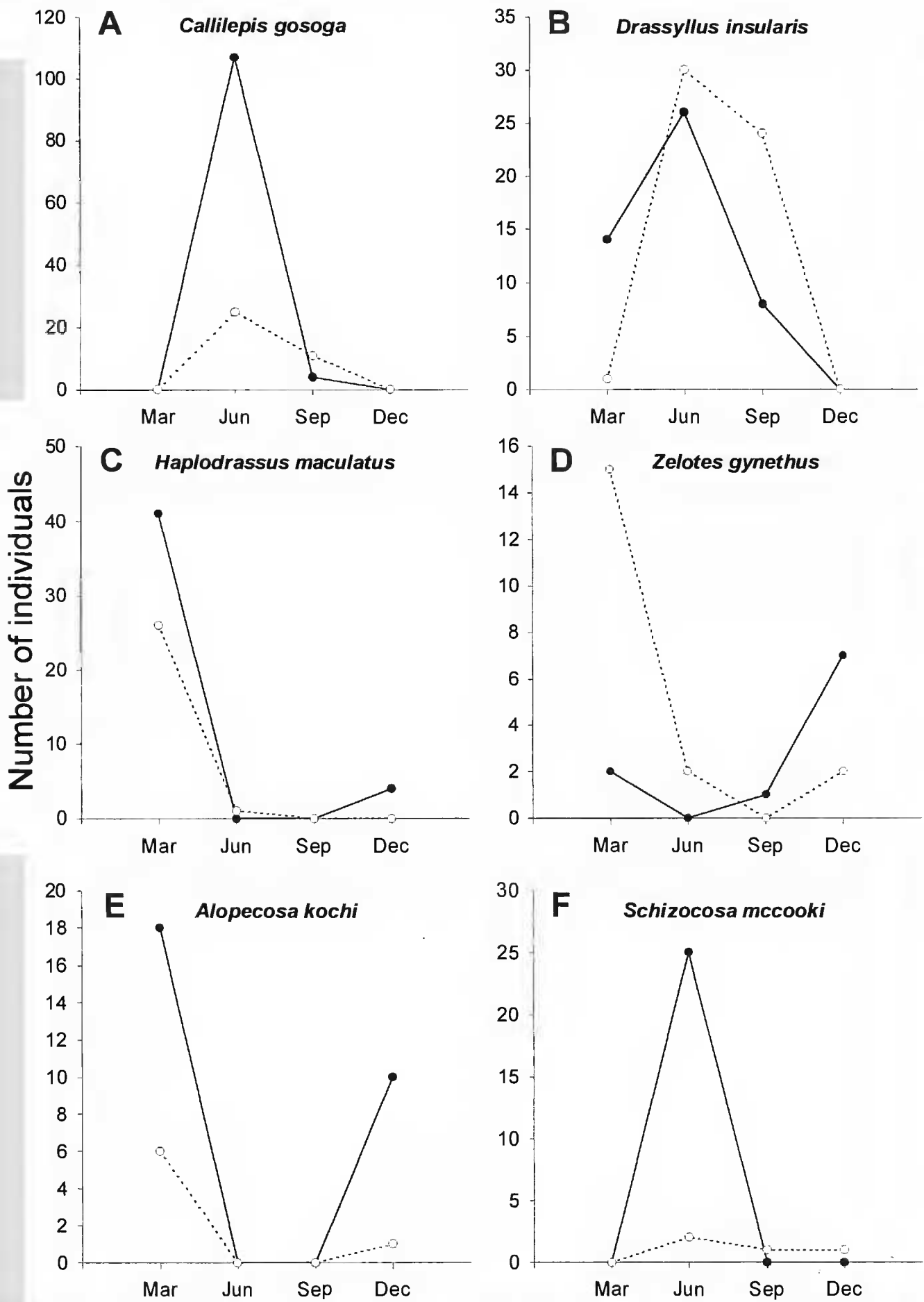


Figure 3. Phenograms of twelve spider species (adults only): A–D, Gnaphosidae; E–F, Lycosidae; G–H, Linyphiidae; I, Pholcidae; J, Salticidae; K, Dictynidae; L, Thomisidae. Collecting periods illustrated on the abscissa were during the first two weeks of each month listed. Pitfall traps (7 per plot; 24 plots) were left open for $72 \text{ h} \pm 4 \text{ h}$. Five one-minute vacuum samples per plot (24 plots) were collected during each sampling period. Closed circles (●) connected by solid lines represent male collections; open circles (○) connected by dashed lines represent female collections.

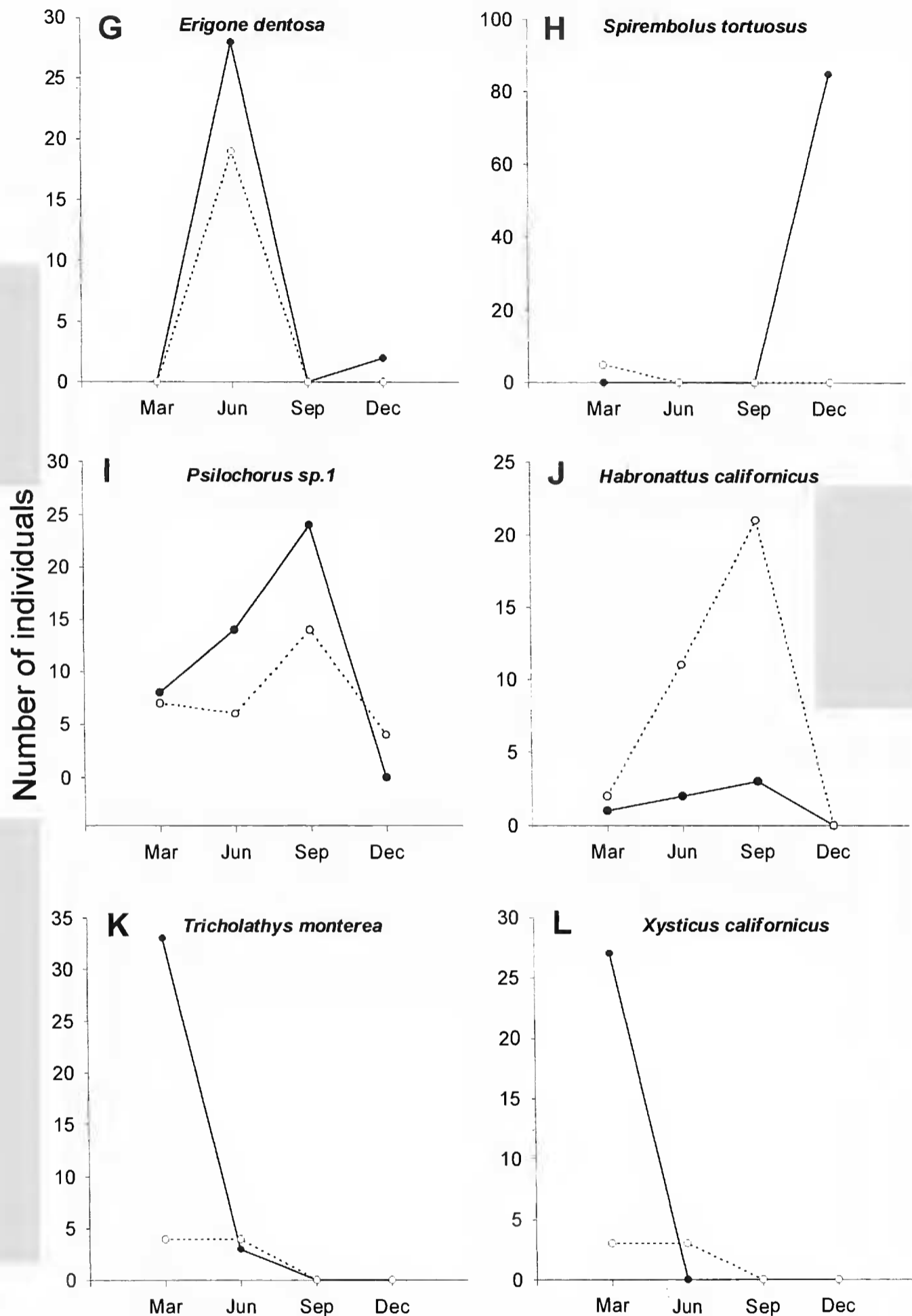


Figure 3. Continued.

during our Riversidian study we may have seen an increase in female activity past the apparent June peak (Fig. 3G). However, the absence of males in early September Riversidian samples may be an indication of a slightly earlier breeding season than that of Diegan populations. The large size of *S. mccooki* and the presence of two distinct juvenile size classes in samples suggest both a biennial

life cycle and alternating generations (Dondale 1977, Hagstrum 1970). However, in populations from pinon-juniper forests in New Mexico, Stratton & Lowrie (1984) found *S. mccooki* to have an annual life cycle.

Alopecosa kochi, inhabiting pine forests in the San Bernardino National Forest, is reported to have a similar two-year life-cycle with alternate generations (Hagstrum 1970). In the mountain populations, penultimates mature in fall with adults overwintering, followed by mating in early spring and egg deposition in early May. In our studies, December and March pitfall catches, as well as hand collection of both males and females in early February from both Riversidian and Diegan study sites, indicate continuous activity throughout the winter months. Unlike pine forest inhabitants, CSS inhabitants presumably mate during the winter months and produce eggs in early March; females with egg sacs were collected as early as 4 March from SRCMR. The absence of adults in both June and September Riversidian samples and in August Diegan samples suggests that adults may expire prior to the hottest and driest part of the summer.

Spirembolus tortuosus (Crosby) and *Erigone dentosa* O. P.-Cambridge were the two most prevalent linyphiid species. All female and all except two males of *E. dentosa* were collected in June 1998 vacuum samples (Fig. 3G); only one male was taken (in June) during the Diegan study. Yeargan & Dondale (1974) reported the take of *E. dentosa* by all methods used (vacuum, sweepnet, pitfall trap) in their study of the spider fauna in alfalfa fields of northern California. Crosby & Bishop (1928) indicate collection records of both sexes from May to September. However, two of our males occurred in March 1996 samples (data not used here) from SRCMR and males, together with females, were collected by hand in early March at SRCMR and in early February at MCBCP. It appears as though adults are present throughout the year but may likely be most active between early June and middle or late August. Males of *S. tortuosus* (Crosby) were collected exclusively in December samples from both Diegan plots and Lake Skinner (Fig. 3H); the few Riversidian females taken occurred only in March samples (December in Diegan samples) and, of these, two were obviously gravid when collected. Millidge (1980) reported male collections in October, November, and January and female collections in September, October, and December through February or March. During independent collecting efforts by one of us in 1998 (TRP), both penultimates and adults were taken from low grasses and by litter sifting between the last week of November and the first week in December. For the remainder of December, only adults were found, suggesting that the peak breeding period occurred in Lake Skinner populations after the first week of December. In agreement with Millidge (1980), we believe that the species breeds during the winter months prior to early March when only females are present. The small proportion of females in samples is probably due to both habitat structure and female behavior. Like many erigonine species, female and juvenile *S. tortuosus* may live in small webs (captive adults spin small, flat webs) that are constructed within moist leaf litter, whereas males actively search for females during the breeding season. Such behavioral differences would account for the disproportionate catch of males in both Diegan and Riversidian studies.

Phenograms of the prevalent pholcid and salticid species, *Psilochorus* sp. #1 and *Habronattus californicus* (Banks), respectively, reflect similar activity patterns (Figs. 3I, 3J, respectively). Field collections of both male and female *Psilochorus*

sp. #1 in December and February at MCBCP and at SRCMR indicate, however, that adults of the species are most likely present year-round. December field collections at both locations yielded only female *H. californicus*; males were not found in December at MCBCP nor between November and late January at SRCMR. Both species are thought to have an annual life cycle. Maturation of captive *H. californicus* spiderlings (egg sacs produced and young reared in lab) occurred in approximately six to seven months. The presence of juveniles of several size classes within both *H. californicus* and *Psilochorus* in a given June or September sample suggests that the respective females may breed and produce egg sacs during several months of the year. This stands to reason given that *Psilochorus* males are found throughout the year, *H. californicus* males occur during ten of the twelve months, and gravid *H. californicus* females were collected in both June and September samples. The September peak of *H. californicus* (Fig. 3J) may be indicative of increased foraging activities, which may be necessary due to the scarcity of prey. By September, most of the vegetation, that the spider's prey may depend upon for sustenance, has either long since senesced or become summer dormant. Unlike that of *H. californicus*, the September peak of *Psilochorus* (Fig. 3I) may reflect shelter-seeking activity, which may be necessary to avoid desiccation from the summer heat. The vast majority of the specimens observed in the field were discovered beneath rocks or under other objects that provided both a dark refuge and insulation from the heat. Although unset pitfall cups were covered with both plastic lids and masonite boards (weighted with rocks), *Psilochorus* adults and subadults were repeatedly discovered in small webs within the cups, immediately before the traps were set in early September. When initially opened, most pitfall cups had condensation droplets on the inside surfaces. Set traps likely provided a very similar environment, attracting *Psilochorus* seeking shelter, and, in turn, accounting for the September take.

Phenograms of the dictynid, *Tricholathys monterea* (Chamberlin & Gertsch), and the thomisid, *Xysticus californicus* Keyserling, indicate late winter activity of males but little cursorial activity of females in either late winter or spring (Figs. 3K, 3L, respectively). In Diegan CSS, both males and females of *T. monterea* were relatively common in mid- to late spring but the only specimens of *X. californicus* collected (3 females) were taken in May/June samples. Chamberlin & Gertsch (1958) report collection dates for adult *T. monterea* from late March to late May with the majority of specimens examined collected in early to mid-May. Taken together with our data, it appears that the species' breeding season peaks between early and late spring. Egg deposition may occur during the early part of the summer. Schick (1965) reported common collection of *X. californicus* adults from March to July throughout most of the species' southern California distribution. However, during several visits to both study areas in early February of 1997 and 1998, we observed an abundance of penultimates and adults of both sex, although the adult to penultimate ratio was apparently greater in males (> 0.5) than in females (< 0.5). Based on the apparent disappearance of males in Riversidian CSS by early June (Fig. 3L) we can predict a mid-winter to mid-spring breeding season within these populations.

Occurrence Patterns in Burned vs. Unburned Plots.—For characterizations of burned and unburned plots refer to *Study Sites* under Methods. Few species were collected in large enough numbers to discern a pattern of occurrence in burned

vs. unburned plots. Of the 12 most prevalent species discussed immediately above, five species occurred in equal numbers ($\pm 4\%$) in burned and unburned plots. One species, *Alopecosa kochi*, was collected more frequently in unburned plots (60% of specimens), and six species, *S. mccooki*, *S. tortuosus*, *E. dentosa*, *Psilochorus* sp. #1, *X. californicus*, *T. monterea*, occurred more frequently in burned plots (59, 79, 76, 60, 100, and 66% of specimens, respectively). Ten of the 11 *Zelotes monachus* Chamberlin and all specimens of *Habronattus hirsutus* (Peckham & Peckham) were taken from unburned plots, 5 of 6 *Scaphiella hespera* Chamberlin and 10 of 13 *Dictyna abundans* Chamberlin & Ivie specimens came from burned plots. *Spirembolus tortuosus*, *X. californicus*, and several other species (not listed above) that exhibited patterns of occurrence are further discussed below in the *Natural History* subsection, *Habitat Preferences*.

Probable Endemic Species.—Because we did not sample in chaparral communities, nor in other communities which are often intimately associated with CSS communities in southern California, we use the term *endemic* to mean “restricted to a particular area” following Anderson (1994). Eight species are here considered as probable endemics to southern California (Riverside, San Bernardino, Los Angeles, Orange, and/or San Diego counties) exclusive of the mountain and desert regions: *Orthonops zebra* Platnick, *Micaria capistrano* Platnick & Shadab, *M. icenoglei* Platnick & Shadab, *Zelotes skinnerensis* Platnick & Prentice, *Linyphantes aliso* Chamberlin & Ivie, *L. microps* Chamberlin & Ivie, *L. obscurus* Chamberlin & Ivie, *Scotinella kastoni* (Schenkel). One species, *Plectreurys tecate* Gertsch is believed to be endemic to SW San Diego County and adjacent Baja, California. Refer to Prentice et al. (1998) for additional data on species collected only during our Diegan study.

Orthonops zebra (Caponiidae): In his revision of *Orthonops*, Platnick (1995) examined 41 specimens, most of which were collected by one of us (WRI) from Riversidian CSS near Winchester (approximately 15 km N of SRCMR). Two specimens were collected in chaparral communities in the Santa Ana Mountains (Orange and Riverside counties, respectively), west of Murietta. We collected two additional males in June pitfall samples from Riversidian CSS at SRCMR (the majority of the males that Platnick examined were collected in March). All known specimens were taken within an 18 km radius of Murietta. Three of the other nine known *Orthonops* species are presumed to have limited distributions in southern California (Platnick 1995); one of these species, *O. johnsoni* Platnick, is known only from Johnson Canyon (San Diego County), a habitat of chaparral and Diegan CSS.

Micaria capistrano (Gnaphosidae): Seven of the nine known specimens (male unknown) were collected from either Diegan CSS or chaparral communities (Baja specimens) in either SW San Diego County (MCBCP and MNAS) (3 females) or in Baja California Norte (4 females, see Platnick & Shadab 1988). These localities are separated by approximately 265 km. Of the two remaining known specimens, one was collected from the Box Springs Mountains, Riverside County (Riversidian CSS), the other in the Santa Ana Mountains near the Riverside County border (probably from chaparral). The lack of specimens in Riversidian samples during the present study and in independently collected CSS samples (collections spanning nearly 30 years) near Winchester by one of us (WRI), suggests that the species is very rare, if it naturally occurs, this far north.

Micaria icenoglei (Gnaphosidae): A total of 23 specimens, collected exclusively from or closely adjacent to CSS, are known. Eight of these were collected from Riversidian CSS, seven near Winchester (two males were collected near buildings adjacent to CSS) (see Platnick & Shadab 1988), and one male during our present study. The remaining 15 specimens were collected during our Diegan CSS study. If the distribution of *M. icenoglei* is continuous from Winchester to San Diego County it seems likely that the species also inhabits chaparral communities, at least the lower elevation communities.

Zelotes skinnerensis (Gnaphosidae): The three known specimens (Platnick & Prentice 1999), two males and one female, were collected from two plots within 600 m of the NE lakeshore of Lake Skinner (SRCMR). Because the revision (Platnick & Shadab 1983) of the genus was based on a large amount of material and because one of us (WRI) has collected Araneae in southern California for thirty years without encountering the species, *Z. skinnerensis* is here considered either rare or very secretive.

Linyphantes aliso (Linyphiidae): This species was described from a female holotype from Laguna Beach (also female paratypes); the male was then unknown and as yet remains undescribed. Although degrees of latitude and longitude were provided in the original description (Chamberlin & Ivie 1942), it is next to impossible to determine the exact habitat from which the specimens were taken in light of the development within the Laguna Beach area since 1942. Both CSS and chaparral are (presently) common in the undeveloped and undisturbed areas just north of the town proper. An additional 30 specimens were collected from Diegan CSS, including 10 males, several of which were present with females in various plot samples. The species was absent from Riversidian samples although one male and one female were collected in pitfall traps at Santa Rosa Plateau Ecological Reserve in SW Riverside County. The most southerly-inhabited region (within MNAS) is approximately 100 km S of the type locality; all known collection localities are within approximately 40 km of the coast.

Linyphantes microps (Linyphiidae): This species was described from a single male taken in Irvine, Orange County (latitude and longitude provided in original description) (Chamberlin & Ivie 1942). To our knowledge, the male holotype is the only published record of *L. microps* prior to our work here. During our present study, we collected two males in March samples from Riversidian CSS along with two females that we determined to be conspecifics.

Linyphantes obscurus (Linyphiidae): This species was described from a single female collected in December; the type locality is the same as that of *L. aliso*. We collected 17 males (*Linyphantes* sp. #3) in December samples during our Diegan study but were unable to determine the species then because the male of *L. obscurus* has not been described. A female of *L. obscurus*, along with 28 males (determined to be conspecific to both the female and the 17 males from San Diego County) were taken (Coll.: C. Dunning) in December by pitfall trap at Santa Rosa Plateau Ecological Preserve in SW Riverside County. The plots from which these specimens came are composed primarily of Engelmann oak, coast live oak, and native perennial grassland. Specimens were not discovered at SRCMR. To date, the species is known only from San Diego, Orange, and Riverside counties.

Fourteen of the 19 described *Linyphantes* species occur in California (Chamberlin & Ivie 1942), 11 of which are known only from California. The type

species, *L. aeronauticus* (Petrunkevitch) is the only member of the genus known to have an extensive distribution, occurring in Idaho, Wyoming, Oregon, Utah, Nevada, California, Arizona, and probably several additional states. All other congeners are known only from western coastal localities (Canada, Washington, Oregon, California, or Mexico). At least three of our seven purported *Linyphantes* species (from both studies) are believed to be undescribed. When generic revision of *Linyphantes* is eventually undertaken, we may find that there are several *Linyphantes* species that are endemic to our region.

Scotinella kastoni (Liocranidae): This species was described from a single female collected 28 Dec 1938 from Balboa Park, San Diego (Schenkel 1950); the male has not been described. Because the hills in and around the zoo are of low elevation and were likely to have supported CSS (rather than chaparral) prior to urbanization, it is probable that the landscape from which the specimen was collected was composed primarily of CSS. We have collected an additional 108 specimens, 25 from CSS (7 males, 14 females during our Diegan study and 4 females during our present study) and 83 from oak-savanna habitats at Santa Rosa Plateau. To our knowledge, there are no additional published locality records of *S. kastoni*. The apparent distributional limits of the species (assuming a continuous distribution) extend from Lake Skinner to Balboa Park, a terrain composed of chaparral and CSS, covering a distance of approximately 100 km.

Plectreurys tecate (Plectreuridae): The only three heretofore known specimens (2 males, 1 female) were collected 16 May 1952, 8 mi. W of Tecate, Baja California (Gertsch 1958). CSS is present in the general area although it appears to be either restricted to relatively small discontinuous patches or intermixed with Californian chaparral, which provides the major canopy cover in the region. Specimens of *P. tecate* were not taken in Riversidian samples but two additional males were collected from the same plot at MNAS (between 12–19 May 1996). The canopy cover of this plot has both CSS and chaparral components, the latter including *Adenostoma fasciculatum* Hooker & Arnott (chamise) and *Yucca whipplei* Torrey. Throughout the approximate 40 km gap between the type locality and MNAS both CSS and chaparral are the primary vegetation types. Data indicate that *P. tecate* prefers relatively dry habitats with enough surface soil and moisture to support the growth of the transitional (chaparral to CSS) chaparral elements. In all likelihood, the distribution of this species is probably more extensive in Baja, California than in California. The remaining species in the *P. castanea* group (9 species) are known only from California. Seven of these species apparently have restricted distributions in southwestern part of the state; the other two species, *P. monterea* Gertsch and *P. castanea* Simon, are known only from Monterey County and from San Mateo County to San Diego County, respectively (Gertsch 1958).

Non-native Species.—The following six known non-native species were collected either in Riversidian CSS samples or by hand (Table 1; denoted by the superscript ‘NN’): *Oecobius annulipes* Lucas, *Zelotes nilicola* (O.P.-Cambridge), *Dysdera crocata* C. L. Koch, *Holocnemus pluchei* (Scopoli), *Steatoda triangulosa* (Walckenaer), and *Menemerus bivittatus* (Dufour). Only one male and female of both *O. annulipes* and *Z. nilicola* and one female of *D. crocata* were found in Riversidian samples. Specimens of *H. pluchei*, *S. triangulosa*, *M. bivittatus* were

collected by hand at or near the entrance station and are discussed below. Refer to Prentice et al. (1998) for data on *O. annulipes*, *Z. nilicola*, and *D. crocata*.

Holocnemus pluchei (Pholcidae): Of Mediterranean origin (Porter & Jakob 1990), *H. pluchei* appeared in California during the early 1970s. One of us (WRI) collected the species in Sutter County, California in 1974, which may be the earliest California record (Porter & Jakob 1990). We found no records that indicated when the species was first reported within the United States. Boe (1986-unpublished) reported collection records in Imperial, Los Angeles, Napa, Riverside, and Sonoma Counties and from the San Joaquin and Sacramento Valleys. Porter & Jakob (1990) conducted their studies of *H. pluchei* from populations in Riverside, Los Angeles, Kern, Fresno, and Yolo Counties. The species has since been observed by one of us (TRP) in San Bernardino County (Loma Linda) and in San Diego Co. (Spring Valley). Our one specimen (female) was collected in 1998 from its web in the angle of the soffit and walls of the entrance station outbuilding. Two additional specimens appearing to be subadults were also present in the web. In both 1996 and 1997, another pholcid, *Physocyclus californicus* Chamberlin & Gertsch, had occupied the available spaces under these eaves but in 1998 was absent, suggesting displacement by *H. pluchei* (not observed in previous years). In another example of probable displacement by *H. pluchei*, we refer to a third pholcid species, *Artema atlanta* Walckenaer. One of us (WRI) had observed, for several years, a healthy population of this very large, primarily neotropical species under the Hwy 115 bridge crossing the Alamo River just west of Holtville, Imperial County, California. In October 1998, two of us (WRI & TRP) revisited the site to find a dwindling *A. atlanta* population and, for the first time, *H. pluchei*, the population of which outnumbered that of *A. atlanta* by an estimated 2/1 ratio.

Steatoda triangulosa (Theridiidae): Quite possibly of European origin, *S. triangulosa* may have been reported in the United States (Georgia) as early as 1850 (see Levi 1957). The majority of early collection records indicate that the species was originally introduced in one of the eastern seaboard states prior to 1900. Levi (1957) indicated records in California in only two counties, Alameda and Solano. Boe reported its distribution from San Diego and Imperial counties north to Siskiyou and Nevada counties. Two of our three specimens (male, female) were collected from the same outbuilding on which the pholcids had resided. Notably, both specimens were collected from small webs confined to the extreme corners slightly above the expanded webs of the resident pholcids, the female above *Physocyclus californicus* in 1997 and the male above *Holocnemus pluchei* in 1998. The third specimen (female) was collected from its web in a recess on the upper inner surface of a road culvert (culvert approximately 1 km S of entrance outbuilding).

Menemerus bivittatus (Salticidae): Probably originating in the Old World Tropics (Edwards 1979), the species now occurs in Puerto Rico, Costa Rica, and Mexico, north to the southern United States. In the U.S., there are records in most of the southern states from Florida to California. In California the species is found as far north as Sonoma County. Both specimens collected at SRCMR were found on the walls of the entrance station outbuilding. Throughout the course of our study, both juveniles and adults were commonly seen on the building when the days were warm and sunny, but were never observed within the native vegetation.

Non-native spider invasions appeared to be minimal in Riversidian CSS compared to those in coastal Diegan CSS. Evidence from our Diegan study suggests that the non-native spider species are more likely to occur in greater numbers in CSS habitats that are less variable in temperature and have higher summertime humidity than Riversidian CSS habitats. Secondly, human traffic promotes the introduction and subsequent spread of non-native species inadvertently hitching rides. Obviously, the human element has a substantially greater impact on the introduction and spread of non-native species at MCBCP and MNAS (both heavily traveled and in very populated areas) than at SRCMR (most parts are closed to human traffic and the reserve is in a relatively isolated area). *Holocnemus pluchei*, *S. triangulosa*, and *M. bivittatus* were probably not encountered during our Diegan study because we failed to search manmade structures at either base. All three species have been collected by one of us (TRP) from two residences in Spring Valley, San Diego County.

Natural History.—Habitat Preference: Only a few of the species collected in either Riversidian or Diegan CSS were prevalent enough in samples to provide any insight into their habitat preferences. Collection results suggest that two of the common Riversidian species, *Spirembolus tortuosus* (Linyphiidae) and *Xysticus californicus* (Thomisidae) prefer relatively open microhabitats with an understory of grassy areas and a significant amount of grass or leaf litter or small prostrate forbs. *Spirembolus tortuosus* seems to prefer valleys or gentle south facing hillslopes with a significant amount of ground litter. In our Diegan study, *S. tortuosus* was distributed in 40 of the 60 plots. However, plots with sparse shrub cover and ample ground litter provided nearly half of the specimens. Of the specimens that occurred in plots with a dense shrub cover, most (70%) were from valley plots with grassy areas and abundant leaf or grass litter. Over 80% of the specimens collected during our present study occurred in plots recovering from the 1993 Winchester burn (burned plots); all of these plots were characterized with a sparse shrub cover, ample annual grass and forb cover, and abundant litter. The ground-dwelling thomisid, *Xysticus californicus*, also seems to prefer open grassy areas with either grass and/or leaf litter or a patchy prostrate forb layer. All of the Riversidian specimens occurred in samples from recovering burned plots; the three specimens collected in Diegan samples came from plots with similar percentages of shrub cover and understory composition. The largest number of specimens (> 50) that we observed at any one time was on a gentle, bare SW slope (MCBCP) carpeted with an *Erodium* sp. (storksbill).

Among the Dictynidae, collection results from both our Riversidian and Diegan studies suggest that *Blabomma* spp. prefer CSS habitats that offer the most humid microhabitat conditions (i.e., valleys, northern exposures, dense canopy layer, significant leaf litter, and grassy areas). *Blabomma sanctum* Chamberlin & Ivie occurred only in unburned plots with dense shrub canopies at SRCMR; nearly 80% of the specimens came from north facing plots. Of these, close to 95% were taken from one plot (Fig. 1, region E) characterized by a very dense shrub cover primarily of California Sage (*Artemisia californica*) and secondarily of California Buckwheat (*Eriogonum fasciculatum*) and Black Sage (*Salvia mellifera*) and an essentially bare substrate with sparsely distributed *Schismus* grass. Leaf litter was abundant but present only near the shrub bases. The two specimens occurring in Diegan samples were from plots with patchy shrub cover but with a relatively

dense understory of annual grasses. All specimens of the undescribed (or undetermined) *Blabomma* species (sp. #1, #2, #3) from Diegan samples were taken from plots with chaparral elements (primarily chamise) as either major or important minor shrub components (the presence of chaparral elements is indicative of more moist conditions than those supporting only CSS). Two of these plots were in valleys and two were SW and SSE exposures, respectively, with dense shrub covers and little bare ground between shrubs. All except one specimen (*Blabomma* sp. #5) of the three undescribed (or undetermined) Riversidian *Blabomma* species (sp. #4, #5, #6) were collected from plots that either had dense shrub canopies, were located on north slopes, or had abundant grassy patches and ground litter. Of the 41 total *Blabomma* specimens taken, only four males of *Blabomma* sp. #5 were in samples from burned plots.

Among the Tetragnathidae, the three species of *Tetragnatha* collected at SRCMR occurred only in plots near Lake Skinner's north shore. Both *T. guatemalensis* O. P.-Cambridge and *T. versicolor* Walckeraer were taken within 250 m of the shoreline (Fig. 1 region D), while *T. pallescens* F. P.-Cambridge was found at a maximum distance of 600 m from shoreline (Fig. 1, region E). Levi (1981) reported *T. versicolor* as one of two *Tetragnatha* species occurring furthest away from water. Given the hot and dry summer conditions of inland southern California, it was not surprising to find this species so close to water (Fig. 1, region D). The *T. pallescens* female found furthest from water was collected from a gentle north facing hillslope. During July and August, literally hundreds of *T. guatemalensis* webs were spun every evening between the stems of dead mustard plants along a service road, less than 100 m from the N shoreline (Fig. 1, region D). Males and females, in copula, were observed at night in the female webs throughout July and early August. By day, only traces of the webs were seen, the inhabitants almost invisibly stretched out against the mustard stems. *Larinia directa* (Hentz) and *Neoscona* (primarily juveniles) webs were commonly interspersed among the tetragnathid webs during these months.

Although relatively few adults of the araneid species, *Metepeira crassipes* Chamberlin & Ivie and *M. grandiosa grandiosa* Chamberlin & Ivie, were collected in samples, both species are very common at SRCMR, particularly on the north side of Lake Skinner (Fig. 1, regions D, E). Observational evidence suggests that these congeners prefer to construct their webs in CSS in areas where the canopy cover is patchy and in vegetation types that provide natural spaces within the shrub itself for web construction. *Eriogonum fasciculatum* (California buckwheat) appeared to be, by far, the most commonly used CSS shrub (refer to Levi 1977), generally occupied by *M. grandiosa grandiosa* in the spring and by *M. crassipes* in the fall. Secondary web sites observed include dead mustard (where dense) and *S. mellifera* (black sage). Of the major CSS shrub components, *A. californica* (California sage) appeared to be the least frequently used (contra natural history reported by Levi (1977)).

Ant Predators: On various occasions in the spring of 1999, two gnaphosid species and one theridiid species were observed attacking and feeding on ants at MCBCP. A penultimate *Callilepis gosoga* male was observed attacking a harvester ant worker (*Pogonomyrmex subnitidus* Emery) approximately 3 m from the harvester mound. While still in its penultimate instar, the *C. gosoga* male was provided a second species of harvester ant, *Messor andrei* (Mayr) which it at-

tacked and fed on. The European congeneric species, *Callilepis nocturna* (L.), is a known ant specialist (Heller 1974, 1976; in Foelix 1982).

The male of the gnaphosid species, *Gnaphosa californica* Banks, was observed attacking a worker formicine (*Formica francoeuri* Bolton) in a fashion similar to that of a wolf spider attacking large prey. In such an attack, the prey is bitten and simultaneously wrapped with all eight legs of the spider.

The theridiid species, *Steatoda fulva* (Keyserling) is known to feed on harvester ants (Hölldobler 1970). This species was not collected during the course of either this or the Diegan study but was subsequently collected at MCBCP. A penultimate male was observed in the process of wrapping a struggling harvester ant (*Pogonomyrmex subnitidus*) within its web in a depression on the ant mound.

CONCLUSIONS

Species diversity within the majority of taxonomic levels examined was greater in Diegan CSS than in Riversidian CSS, especially within the Theridiidae, Gnaphosidae, and Salticidae. This, we believe, is largely due to the coastal climate, which produces both more summertime moisture and moderate temperatures than the corresponding inland areas and promotes the growth of a wider variety of shrub species. For example, several of the theridiid species sampled in coastal Diegan CSS are known primarily from coastal localities and/or inland canyons. Such species include *Dipoena atopa* (Chamberlin), *D. prona* (Menge), *Thymoites expulsus* (Gertsch & Mulaik), *Theridion punctipes* Emerton, and *Wamba crispulus* Simon (*Theridion intervallatum* Emerton, synonym). The relatively flat topography of SRCMR and absence of deep canyons, as well as dry summertime conditions, may preclude the establishment of the species. Similarly, gnaphosids such as *Callilepis eremella* Chamberlin, *Drassyllus conformans* Chamberlin, *D. saphes* Chamberlin, and *Zelotes gabriel* Platnick & Shadab are generally known from more mesic localities than those found at SRCMR. These species were collected in coastal Diegan CSS but were not found during this study.

Both the greater number of non-native species (especially cosmopolitan species) and the relatively greater density, per non-native species, in Diegan versus Riversidian samples, suggest that the coastal conditions provide a more hospitable environment than the inland lowlands do for species that desiccate easily. We also found proportionately greater percentages of both new species records and undescribed species for San Diego County (17% and 9.5%, respectively) than for Riverside County (11% and 6.5%, respectively). These records likely reflect a combination of both species immigration and inadequate sampling in the past. Assuming that these variables are approximately equal in both CSS systems, the proportionally greater percentages for San Diego County suggest that the Diegan climate is more conducive to habitation by less adaptable forms than the more extreme Riversidian climate. Proportionately fewer species can tolerate the xeric summertime conditions and seasonal temperature extremes of the inland Riversidian system.

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